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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/779,565	02/09/2001	Takao Kamoshima	49657-986	6592

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EXAMINER	
LE, THAO X	

ART UNIT	PAPER NUMBER
2814	

DATE MAILED: 12/11/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application N .	Applicant(s)
	09/779,565	KAMOSHIMA ET AL.
	Examiner	Art Unit
	Thao X Le	2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Peri d for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10/24/02* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☒ Certified copies of the priority documents have been received in Application No. *09/391,388* .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Specification

1. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1-2, 4-7, 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5523259 to Merchant et al.

Regarding to claim 1, Merchant discloses in fig.1-7, a semiconductor device, comprising a semiconductor substrate 14 and including polycrystals a conductive layer 16.2 including in its surface a recess, fig. 5, having sidewalls formed such that a distance therebetween becomes small as closer to semiconductor substrate.

But, Merchant reference does not expressly disclose the recess caused by a crystal brain boundary.

However, Merchant discloses the aluminum conductive layer 16.1 having relative small average grain size, column 4 line 54-55, and aluminum conductive layer 16.2 having relative larger average grain size than 16.1, column 4 line 62-64. Furthermore Merchant discloses the al layers are deposited at different conditions, which result in grain boundary diffusion and recrystallization and grain growth, column 3 line 52-54. At the time of the invention was made; it would have been obvious to one of ordinary skill in the art such recess as claimed would be a consequential structure as disclosed above and in fig 5 by Merchant.

Regarding to claim 2, Merchant discloses the semiconductor device wherein conductive layer includes a first conductive layer 16.1, fig. 6, formed on semiconductor substrate 14 and including a polycrystals having a first average grain size, column 4 lines 54-55, and a second conductive layer 16.6, fig. 6, formed on semiconductor substrate 14 and including a polycrystals having a second average grain size greater than first average grain size and having recess, fig. 6, column 4 lines 62-64

Regarding to claims 4-5, 9-10, Merchant discloses the semiconductor device wherein first, second and third conductive layers 16.1, 16.2, 16.3, respectively, includes aluminum,

further comprising an insulating layer 20 formed on the semiconductor substrate, and a barrier layer 22 formed on insulating layer, and conducting layer 16.1 being formed on barrier layer, fig. 6.

Regarding to claim 6, Merchant discloses a semiconductor device comprising a first conductive layer 16.1 formed on a semiconductor substrate and including a polycrystals having a first average grain size, column 4 lines 54-55, a second conductive layer 16.3 formed on a first conductive layer and including a polycrystals having a second average grain size greater than first average grain size, column 4 lines 62-64, and a third conductive layer 16.3 formed on a second conductive layer and including a polycrystals having a third average grain size, column 5 lines 517-19.

But Merchant does not expressly disclose the third conductive layer having the average grain size smaller than the second average grain size.

However, Merchant discloses the third conductive layer 16.3 having a relative large average grain size depending on the dimension of the plug. Accordingly, it would have been obvious to use teaching of Merchant in the range as claimed, because it has been held that where the general conditions of the claims are discloses in the prior art, it is not inventive to discover the optimum or workable range by routine experimentation. See In re Aller, 220 F.2d 454, 105 USPQ 233, 235 (CCPA 1955).

Regarding to claim 7, as discussed in claim 1 above Merchant disclose all the limitations in claim 7.

4. Claims 3 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5523259 to Merchant et al in view of Applicant Admitted Prior Art (APA).

Regarding to claims 3 and 8, Merchant does not expressly disclose the semiconductor device further comprising a thin layer formed on conductive layer and third conductive layer and having material different from that conductive or third conductive layer.

But APA discloses the semiconductor device further comprising a thin film TiN layer 109 formed on the conductive layer and having a material different from that of conductive layer, page 1 line 27. At the time the invention was made; it would have been obvious to one of ordinary skill in the art to combine the thin film layer 109 teaching of APA with Merchant, because such thin TiN layer would have provided diffusion barrier layer for the metal interconnection structure.

5. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over US 5244509 to Arao et al. in view of 6172296 to Iwasaki et al.

Regarding to claim 1, Arao discloses in fig.1, a semiconductor device, column 3 lines 60-65, comprising a substrate 101, a conductive layer 102 formed on substrate and including polycrystals a conductive layer 102 including in its surface a recess, concave portion fig. 1, having sidewalls formed such that a distance therebetween becomes small as closer to semiconductor substrate.

But, Arao does not expressly disclose a semiconductor substrate.

However, Arao discloses glass or ceramic substrate can be used, column 6 line 17. Furthermore Iwasaki discloses silicon, glass, or ceramic can be used as solar cell substrate, column 7 lines 64-66. At the time of the invention was made; it would have been obvious to one of ordinary skill in the art to use silicon substrate the teaching of Iwasaki to replace the Arao101 substrate, because such material substitution would have

been considered a mere substitution of art-recognized equivalent values as taught by Iwasaki, column 7 line 65.

Regarding to claim 4, Arao discloses the conductive layer 102 includes aluminum, column 6 line 23.

Response to Arguments

6. Applicant's arguments filed 10/24/02 have been fully considered but they are not persuasive.

- Applicant argues that Arao does not even relate to a semiconductor device. This is not persuasive because Arao discloses the solar cell having thin film semiconductor material, column 3 line 62.
- Applicant argues the Arao's surface irregularities are not desirable in the semiconductor device. This is not persuasive because such irregularities surface (the concave portion), which has the sidewall, formed such that a distance therebetween becomes small as closer to the substrate, thus it meets the claim language.
- Applicant argues that Arao's intentional recesses are not formed by crystal grain boundaries. This is not persuasive because Arao discloses the conductive layer 102 having the irregularities surface is formed by crystal grain boundaries, column 6 lines 52-59.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thao X Le whose telephone number is 703-306-0208. The examiner can normally be reached on M-F from 8:00 AM - 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael M Fahmy can be reached on 703-308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Thao X. Le
December 2, 2002

PHAT X. CAO
PRIMARY EXAMINER